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DESIGN AND FLUID ANALYSIS OF CATALYTIC CONVERTER

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ABSTRACT:

Diesel engines have high efficiency, durability, and reliability together with their low-operating cost. These important features make them the most preferred engines especially for heavy-duty vehicles. The interest in diesel engines has risen substantially day by day. In addition to the widespread use of these engines with many advantages, they play an important role in environmental pollution problems worldwide. Diesel engines are considered as one of the largest contributors to environmental pollution caused by exhaust emissions, and they are responsible for several health problems as well. The four main pollutant emissions from diesel engines (carbon monoxide-CO, hydrocarbons-HC, particulate matter-PM and nitrogen oxides-NO_x) and control systems for these emissions (diesel oxidation catalyst, diesel particulate filter and selective catalytic reduction) are discussed. Each type of emissions and control systems is comprehensively examined. The present project deals with the of filter type emission controller and gases used to analysis suitable for clamping to diesel engine for optimizing the control of emissions before and after usage.

Keywords: *Diesel engine, Emission control system*

1.0 INTRODUCTION

Diesel exhaust soot is the visible cloud of black carbon-containing smoke that appears on engine start-up and during normal diesel engine operation. Black carbon is hazardous to health and presents a range of other issues, including visible product contamination and soiling. It is also believed that black carbon is a contributory factor in climate change. This technical paper aims to clarify the issues surrounding exhaust soot and presents information designed to assist in the decision-making process of how best to reduce black carbon emissions from diesel exhausts.

Catalytic converters:

Catalytic converters are separate systems that reduce carbon monoxide (CO), unburned hydrocarbons (HC) and aldehydes. These exhaust emissions are generally associated with contributing significantly to atmospheric pollution problems and are responsible for irritation to the eyes and respiratory system. They can also cause nausea, headaches and tiredness. These

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effects are further compounded in enclosed spaces such as warehouses, tunnels and mines.

The emissions from diesel engines: The diesel engine is an auto-ignition engine in which fueland air are mixed inside the engine. The air required forcombustion is highly compressed inside the combustionchamber. This generates high temperatures which are sufficientfor the diesel fuel to ignite spontaneously when it isinjected into the cylinder. Thus, the diesel engine uses heatto release the chemical energy contained in the diesel fueland to convert it into mechanical force (Bosch 2005).Carbon and hydrogen construct the origin of diesel fuellike most fossil fuels. For ideal thermodynamic equilibrium,the complete combustion of diesel fuel would only.

Problem statement: Many policies have been imposed worldwide in recent years to reduce negative effects of diesel engine emissions on human health and environment. Many researchers have been carried out on both diesel exhaust pollutant emissions and after treatment emission control technologies. The emissions from diesel engines and their control systems are reviewed and there is a need to develop of pollutant filtration in a practical testing system to check the minimum emission rate.

Objectives:
1. To study the present using emission control systems.
2. To study the fabrication process of making filter type emission control equipment.
3. To check the present emissions in diesel engine with chemical ratios.
4. To check the emissions after assembling new filter.
5. To compare both the emission ratios before and after practically.

2.0 literature review

[1] Heyder et al. 2011; Dai Unless the current mitigation,commitments, and pledges are fully implemented, thenegative effects of climate change will go on. It is expectedthat a warming of 4 _C and sea-level rise of 0.5–1 m canoccur as early as 2060s The greenhouse effect is a natural process that plays amajor role in shaping the earth's climate. Human activities,especially burning fossil fuels, have contributed to theenhancement of the natural greenhouse effect. Thisenhanced greenhouse effect stems from an increase in theatmospheric concentrations called greenhouse gases Greenhouse gases in the atmospherelead to climate change.

[2] Wei et al. 2008;Carbon dioxide (CO_2) has the largest rate among thegreenhouse gases, and it is the main reason of globalwarming. The global emission of carbon dioxide hasreached 34 billion tons with an increase of 3 % in 2011(Olivier et al. 2012). Throughout the world, CO_2 emissionsare currently about 35,000 million metric tons per year

[3] (Prasad and Bella 2010). This article presents a review on the pollutant emissionsfrom diesel-engine vehicles and their control systems. Inthis context, four main pollutant emissions (CO, HC, NOx,and PM) from diesel engines are explained

individually.Worldwide emission control legislation is clarified andtrends in emission control systems especially for heavydutydiesel engine vehicles are explained. Three differentemission control systems are examined as diesel oxidationcatalyst (DOC) to control CO, and HC emissions, diesel

3.0 MATERIALS AND METHODS

STAINLESS STEEL 316

- Stain less steels are iron base alloys containing 10.5% or more chromium. they have used for many industrial architectural chemical and consumer applications for over a half century

- Currently there are being marketed a number of stain less steels originally recognized by the American iron and steel intuits (AISI) as standard alloys .also commercially available are property stain less steels with special characteristics

- A stainless steel in the singular sense as if it were one material .actually there are over fifty stain less steel alloys there are classification are used to identify stain less steels

STAINLESS STEEL - GRADE 316 PROPERTIES:

Type 316 is an austenitic chromiumnickel stainless steel containing molybdenum. This addition increases general corrosion resistance, improves resistance to pitting from chloride ion solutions, and provides increased strength at elevated temperatures. Properties are similar to those of Type 304 except that this alloy is somewhat stronger at elevated temperatures. Corrosion resistance is improved, particularly against sulfuric, hydrochloric, acetic, formic and tartaric acids; acid sulfates and alkaline chlorides

THE 3.1 TABLE SHOWS THAT CHEMICAL PROPERTIES

Grade	c	MN	SI	P	S	CR	MO	NI	N
SS316	0.08 MAX	2.0MAX	0.75 MAX	0.045 MAX	0.03 MAX	MIN:2.0 MAX:3.0	MIN:10.0 MAX:14.0	MIN:10.0 MAX:14.0	0.10 MAX
SS102	0.03 MAX	2.0 MAX	0.075 MAX	0.045 MAX	0.03 MAX	MIN:16.0 MAX:18.0	MIN:16.0 MAX	MIN:2.0 MAX:3.0	0.10MAX

MECHANICAL PROPERTIES:

Grade	Tensile strength ksi(min)	Yield strength 0.2% ksi (min)	Elongation %	Hardness(brinell) max	Hardness (Rockwell b)max
Ss316	75	30	40	217	95
Ss102	70	25	40	217	95

3.3 DESIGN OF SMOKE FILTER:

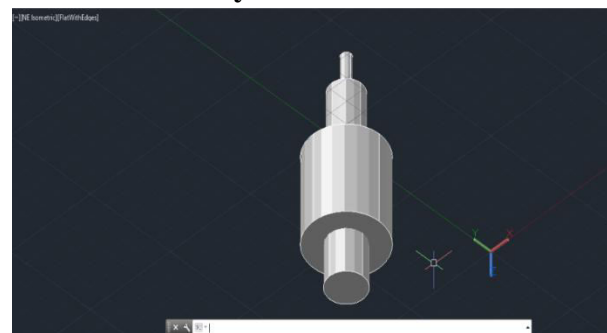**FIGUREURE 3.1plane view of the catalytic converter**

figure 3.2 shows that catalytic converter front view

3.4 POLLUTION EMISSIONS FROM DIESEL ENGINE:

Diesel engines have high efficiency, durability, and reliability together with their low-operating cost. These important features make them the most preferred engines especially for heavy-duty vehicles. The interest in diesel engines has risen substantially day by day. In addition to the widespread use of these engines with many advantages, they play an important role in environmental pollution problems worldwide.

Diesel engines are considered as one of the largest contributors to environmental pollution caused by exhaust emissions, and they are responsible for several health problems as well.

ANALYSIS OF CATALYTIC CONVERTER:
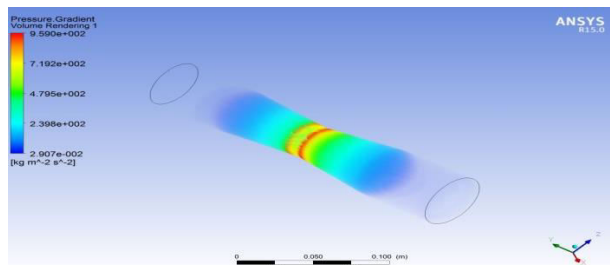
The figure pressure gradeint of the catalytic converter

The above FIGURE shows the pressure graident of the smoke done in ansys having rendring -1 shows the renderenc which has a maximum value at center postion indicated , and is getting varied with a difference 2 the next rendering is found in the next portion to the maximum value and while coming to end the value is getting decreased which can be clearly observed in above FIGUREure done by ansys.

The maximum value obtained at center portion for pressure $9.590e^{+002}$kg m^a -2 s^L-2.

The minimum value obtained at center portion for pressure 2.907e-002 kg m^a -2 s^L -2.
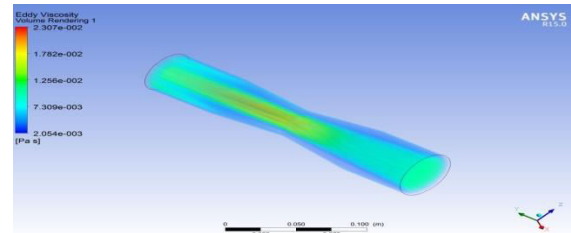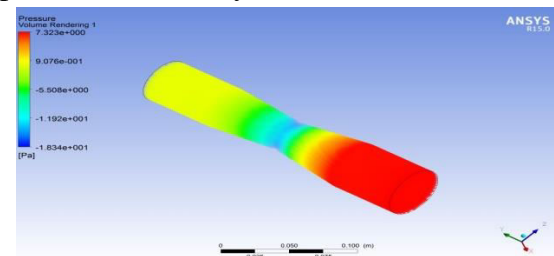

FIGURE: SHOWS THAT VELOCITY GRADIENT

DISCUSSIONS:

The above FIGURE shows the velocity gradient of the smoke done in ansys having rendering -1 shows the endurance which has a maximum value at center position indicated, and is getting varied with a difference the next rendering is found in the next portion to the maximum value and while coming to end the value is getting decreased which can be clearly observed in above FIGUREure done by ansys.

The maximum value obtained at center portion for velocity 2.307 e^{-002}Pa s.

The minimum value obtained at center portion for velocity 2.054e-003 Pa s.

THE FIGURE: SHOWS THAT PRESSURE VOLUME RENDERING OF THE FILTER

DISCUSSIONS:

The above FIGURE shows the mixture of pressure volume the smoke done in ansys having rendering -1 shows the endurance which has a maximum value at end position indicated, and is getting varied at different and with a difference the next rendering is found in the next portion to the maximum value and while coming to end the value is getting decreased which can be clearly observed in above FIGUREure done by Ansys.

The maximum value obtained at end portion for pressure emission is $7.323e^{+000}$ Pa

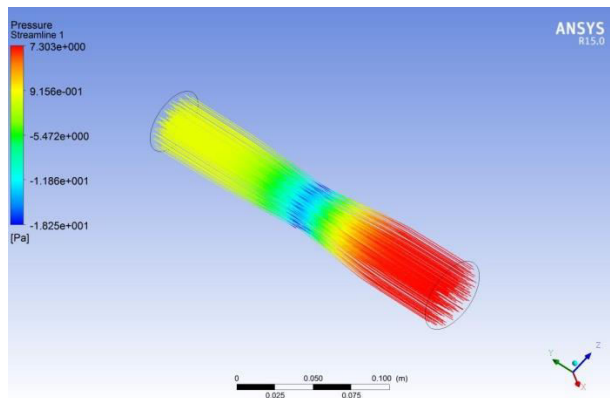The minimum value obtained at end portion for volume emission is $1.834e^{+001}$ Pa.

FIGUREshows that Pressure streamline

DISCUSSIONS:

The above FIGURE shows the mixture of pressure steam line for smoke filter done in ansys having endurance and emission of pressure at both ends and which has a maximum value at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.The maximum value obtained at end portion for pressure steam line is $7.303e^{+000}$ Pa

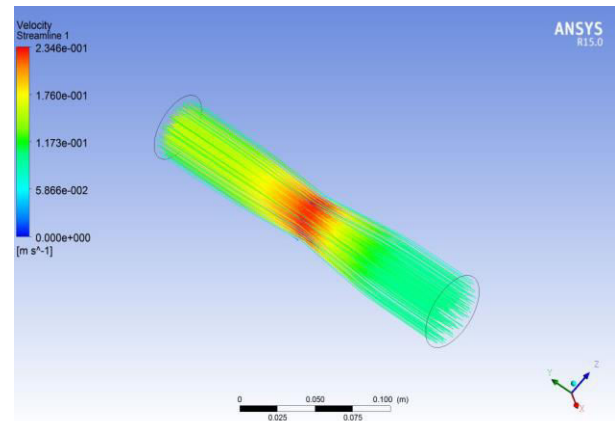The minimum value obtained at the end portion for pressure steam line is $1.825e^{+001}$ Pa

figurethat filter velocity steam line

Discussions:

The above FIGURE shows the mixture of steam line for smoke filter done in ansys having endurance and emission of pressure at both ends velocity which has a maximum value at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for velocity steam line is $2.346e\text{-}001$ ms^{L-2}

The minimum value obtained at the end portion for velocity steam line is $0.00e+000$ ms^{L-2}
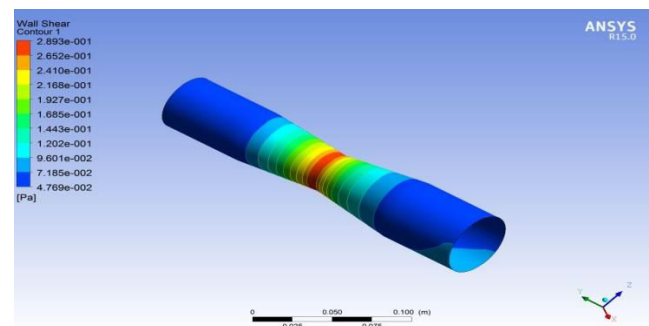

FIGUREshows that filter wall stressing model

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DISCUSSIONS:

The above FIGURE shows the mixture of for smoke filter done in Ansys having endurance and emission of pressure at both ends and which has a maximum value filter wall stressing model at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for is wall stressing model 2.893e-001 Pa

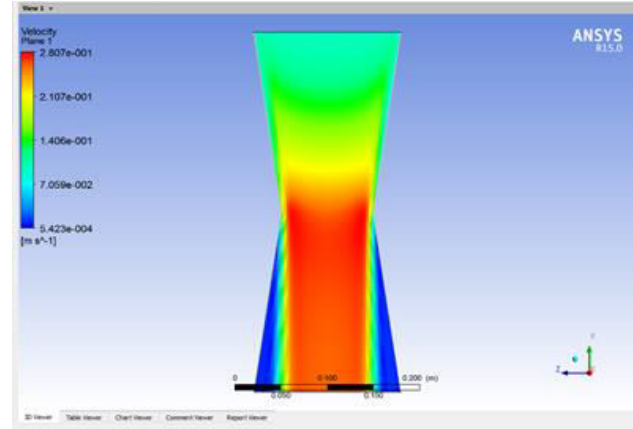The minimum value obtained at the end portion for pressure steam line is 4.96 e-002Pa
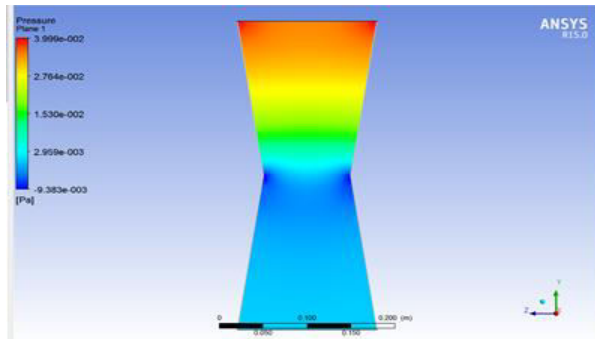
The FIGURE 3.18   Smoke filter of the pressure plane

DISCUSSIONS:

The above FIGURE shows the mixture of pressure planefor smoke filter done in ansys having endurance and emission of pressure at both ends and which has a maximum value at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for pressure planeis 3.900e-002Pa

The minimum value obtained at the end portion for pressure planeis $9.303e\text{-}003^{+001}$ Pa

The FIGURE 3.19 shows that velocity plane filter

DISCUSSIONS:

The above FIGURE shows the mixture of velocity plane for smoke filter done in ansys having endurance and emission of pressure at both ends and which has a maximum value at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for velocity plane is$5.423e^{004}$m sL-1

The minimum value obtained at the end portion for pressure steam line is $2.807e^{001}$ m sL-1

The table shows that the analysis of smoke filters maximum and minimum values		
subject	Maximum deformation	Minimum deformation
Pressure gradient	9.590e+0.02	2.907e-0.02
Filter velocity	2.307e-0.02	2.054e-0.03
Pressure volume rendering	7.323e+000	-1.834e+0.01
Pressure steam line	7.303e+000	-1.825e+0.01
Velocity flow	2.346e-0.01	0.000e+0.000
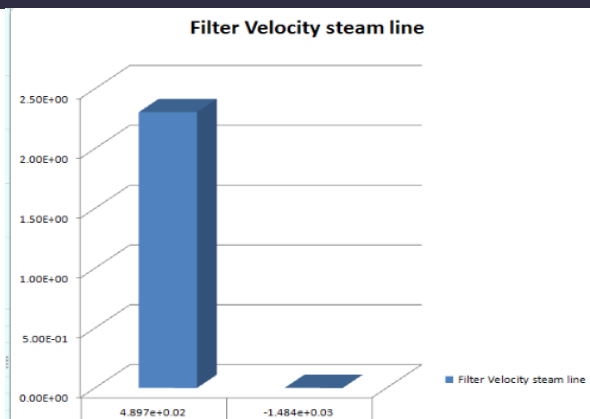
GRAPH THAT FILTER VELOCITY STEAM LINE

Conclusion

The smoke filter characteristics of main pollutant emissions (CO, HC, PM, and NO_x) from diesel engines and control technologies of these pollutant emissions with standards and regulations. Among these pollutant emission, CO and HC are emitted because of incomplete combustion and unburned fuel while NO_x emissions are caused because of high combustion temperatures above 1,600 °C. As for PM emissions, the reasons of PM emissions are agglomeration of very small particles of partly burned fuel, partly burned lube oil, ash content of fuel oil and cylinder lube oil or sulfates and water.

These pollutant emissions have harmful effects on environment and human health. Even though many applications have been implemented on diesel engines to prevent harmful effects of these pollutant emissions and to meet stringent emission regulations, only after treatment emission control systems are of the potential to eliminate the pollutant emissions from diesel exhaust gas.

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